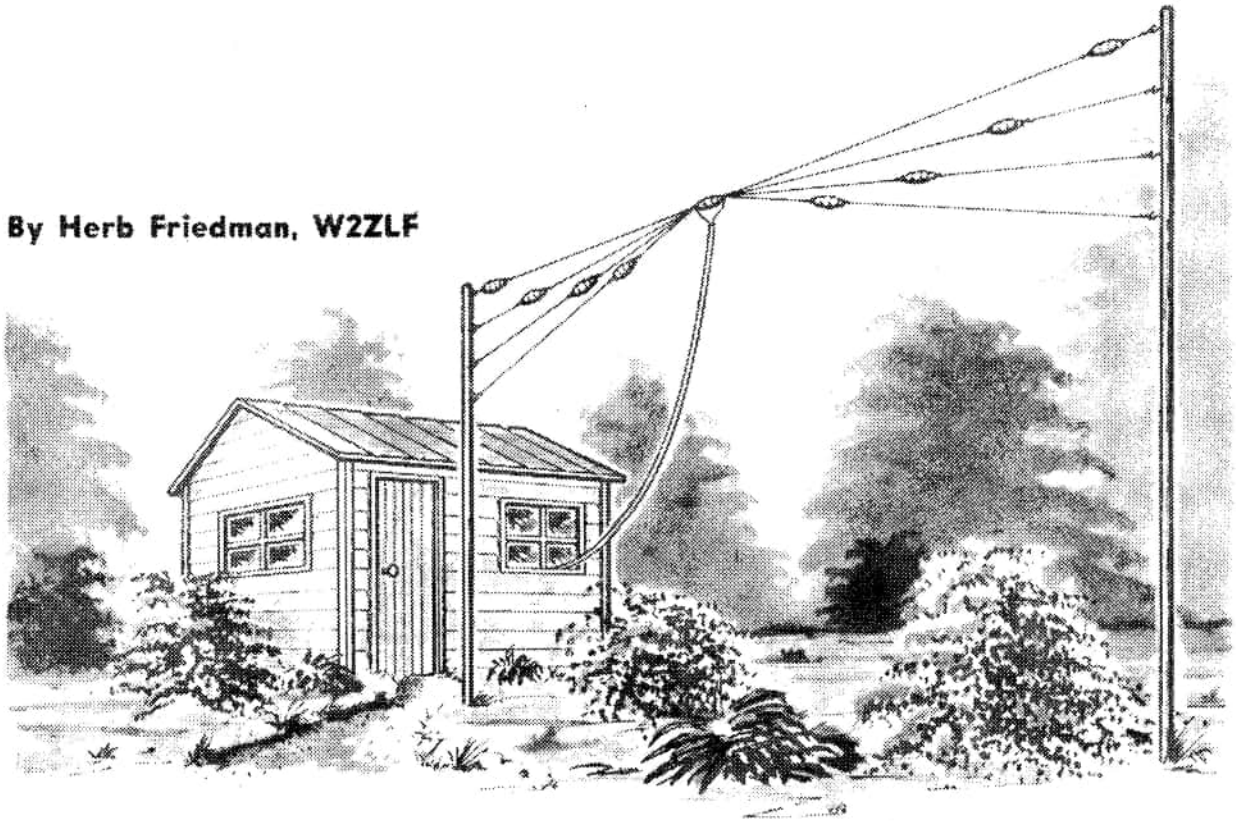
By Herb Friedman, W2ZLF



HAM ANTENNA FACTS

Building or buying an antenna is easy, once you know the score.

ALL TOO OFTEN the newcomer to the amateur ranks grinds along month after month with a hastily erected skyhook. And, though his thoughts may be on that super-duper work-all-countries antenna he plans to erect, he may pump out less signal than if he shouted from a window.

Much of this is understandable, of course. In his first burst of enthusiasm to get on the air, a ham is willing to use anything for an antenna. But there's no reason to settle for inadequacy. Many inexpensive, easily erected antennas—both home-brew and ready-made—can give quite satisfactory performance until you get around to your all-out antenna-raising party.

The Long Wire

The easiest antenna to install is the long-wire, which can be of any length. While it's not the most desirable antenna by a long shot, a long-wire is sometimes a necessity when you're faced with space or a landlord's restrictions.

Figure 1 shows a typical arrangement: the antenna, as high and as free from obstructions as possible, is supported by two poles and is electrically isolated from the poles by means of insulators. An antenna coupler is almost mandatory with a long-wire, and therein lies one of its many weaknesses. All in all, if you're not forced into using a long-wire, you'd do better with one of the antennas which follow.

The Dipole

The simple dipole is capable of giving results which can satisfy you for years. Basically, it's a wire which is one half wavelength long at the operating frequency, broken at the center to permit connection of a transmission line (see Fig. 2). The impedance at the feedpoint is matched easily with standard 52- or 72-ohm coaxial cable or with twin-lead.

For best results, a dipole must be used at the frequency for which it has been cut. However, it also will give good per-

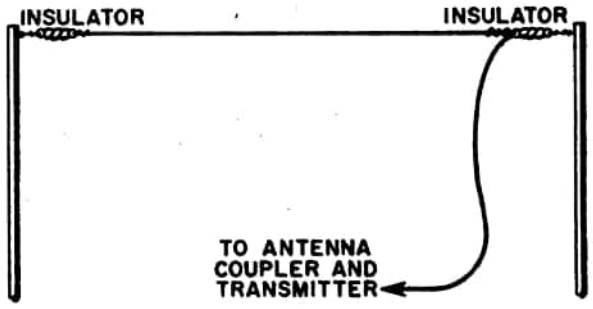


Fig. 1—Long-wire antenna is old as the hills but has one advantage: it can be of any length.

formance on its third harmonic, so a 40-meter dipole will perform efficiently on 15 meters. This feature is particularly handy for the Novice who can work the States on 40 and DX on 15 with only one antenna.

While a dipole is one-half wavelength electrically, it isn't precisely a half-wavelength physically. The insulators at each end contribute a shortening effect of about 5 per cent, and the length (L) is determined from the corrected formula, L (in feet) =468/F (frequency in megacycles).

The Multi-Band Dipole

One way to work several bands without erecting an antenna farm in your back yard is through the use of the multi-band dipole shown in Fig. 3. Such an antenna actually is a number of dipoles all tied to a common feedpoint.

As with the standard dipole, the 40-meter section also can be used on 15 meters. Therefore, a multi-band dipole need consist only of 80-, 40-, 20- and 10-meter sections (or any combination of

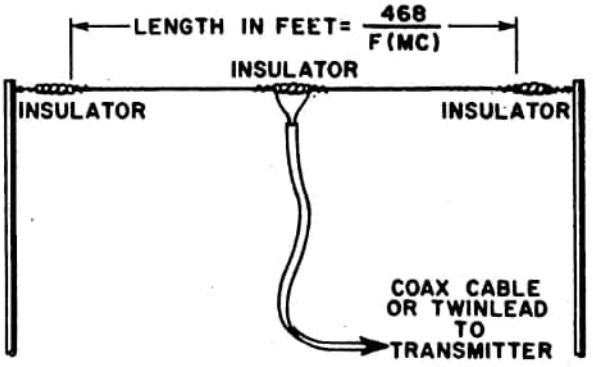


Fig. 2—Half-wave dipole must be cut to a specific frequency. It has an impedance of 72 ohms.

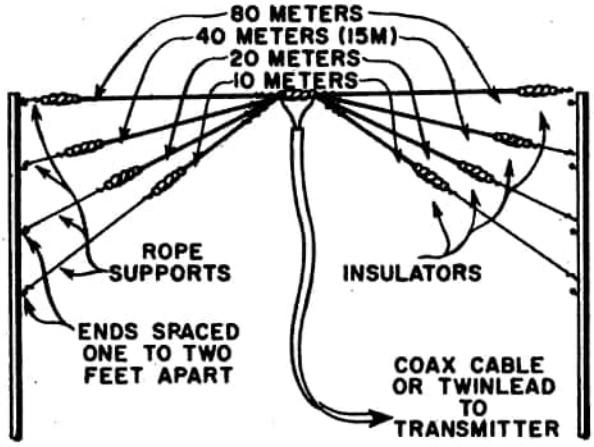


Fig. 3—Multi-band dipole consists of several dipoles connected to a single transmission line.

two or more). The dipole for the lowest frequency can be at the top, with dipoles for successive bands spaced at the ends one to two feet apart. Any non-metallic material can be used for the supports, but wire is *verboten!*

If the multi-band dipole looks like your cup of tea, keep in mind that your transmitter has to be clean. Multi-band antennas radiate harmonics just as well as they do fundamentals. Therefore, if your rig is loaded with harmonics the multi is going to do a great job of pushing them out into space. Only if you are certain your transmitter meets good engineering standards is the multi-band dipole recommended.

The Folded Dipole

The dipole can be modified easily into what is probably the most convenient antenna around—the folded dipole (see Fig. 4). If a second wire is stretched a given distance above the dipole and connected to the ends of the dipole, the ra-

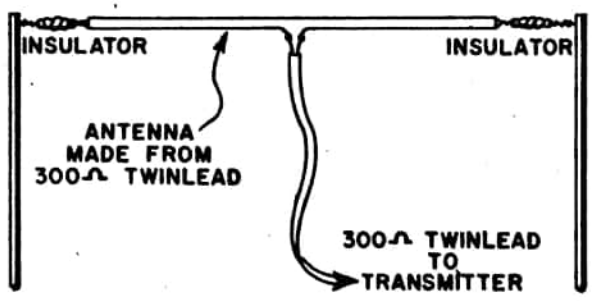


Fig. 4—Folded dipole offers broader response than simple dipole. Its impedance is 300 ohms.

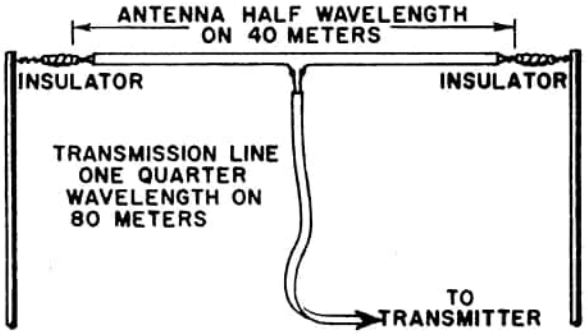


Fig. 5—Resonant folded dipole works on both 40 and 80 meters because of special feedline.

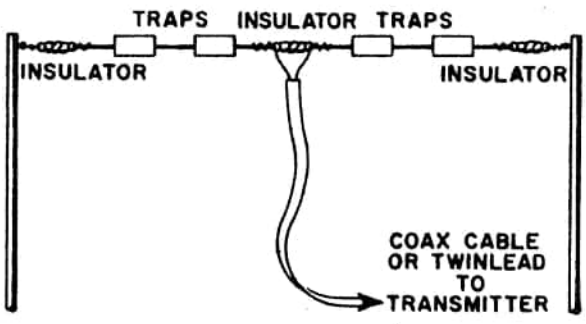


Fig. 6—Trap antenna makes use of resonant L-C circuits for operation on two or more ham bands.

diation resistance is increased approximately four times, to about 300 ohms—a value easily matched with low-cost TV twinlead.

In contrast to a simple dipole, which gives maximum performance at its resonant frequency with a sharp drop on either side, a folded dipole gives good performance over a relatively broad range of frequencies. Cut for the center of the ham band, a folded dipole will give efficient performance over all of that band. To determine the proper length for a folded dipole, use the formula shown in Fig. 2.

Resonant Folded Dipole

For 80-meter enthusiasts with 40-meter space, the resonant folded dipole shown in Fig. 5 may be the answer. It is cut for 40 meters and can be made conveniently from 300-ohm twinlead.

Naturally, if used on 80 meters, its radiation resistance would be too high to match with commercial twinlead. However, when the transmission line is an exact quarter-wavelength of 80 meters, the feeder acts as an impedance-matching transformer between transmitter and antenna. As a result, good performance can be expected.

When determining the length of the transmission line, it's important to take into account the *velocity factor*—a characteristic which shortens the line electrically. The velocity factor for common twinlead is 0.82, and the length in feet for a quarter-wave section is 246 / F (mc) x 0.82. If you want to save yourself a little time, you can buy an 80-meter folded dipole made from 300-ohm twinlead and trim it down to size.

The Trap Antenna

Still another popular ham antenna is the multi-band trap shown in Fig. 6. Whereas a dipole is useful only on the frequency for which it is cut—or the third harmonic of that frequency—trap antennas can cover two, three or all bands, 80 through 10 meters.

To effect multi-band operation, traps (resonant L-C circuits) are installed in both legs of the antenna. These traps alter the length of the antenna electrically so it is resonant at the signal frequency. Since the traps are automatic in operation, all you have to do to change bands is change the transmitter's frequency.

Trap antennas have another important advantage: they can be made physically shorter than an equivalent dipole. Whereas you might not have sufficient space for an 80-meter dipole (or long-wire), you may have room for a short trap antenna.

The same precaution which applies to a multi-band dipole applies to a trap. Since a trap antenna also does a great job of radiating harmonics, it's imperative that your transmitter be clean.

While there are many other types of antennas, the ones we've discussed offer the hard-to-beat advantages of easy installation and good performance. At least one of them is bound to meet your specific requirements. Take a little extra care with the installation, and a good, efficient antenna system can be yours.